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09/697,703

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Comments:

As requested, attached is the Supplemental Appeal Brief w/ a clean set of appealed claims.

- Hyung Sohn

Appl No: 09/697,703
Attorney Docket: 4450-0160P



**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

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|---|---|---|---|
| Applicants: | Michael G. TAYLOR | Appeal No.: | |
| Appl No: | 09/697,703 | Art Unit: | 2633 |
| Filed: | October 27, 2000 | Examiner: | A. BELLO |
| For: | POLARIZATION MODE DISPERSION COMPENSATING APPARATUS, SYSTEM AND METHOD | | |

**SUPPLEMENTAL TO THE APPEAL BRIEF FILED ON JUNE 30, 2004**

July 5, 2005

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This is a supplemental to the Appeal Brief file on June 30, 2004 filed on behalf of Michael G. Taylor. This Supplemental includes a clean set of appealed claims in an appendix.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional

fees required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

Respectfully submitted,

BIRCH, STEWART, KOLASCH &, BIRCH, LLP

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APPENDIX

**The Appealed Claims**

1. A polarization mode dispersion compensating apparatus, comprising:

a polarization mode dispersion compensator optically coupled to an input port and receiving an input optical signal having polarization mode dispersion and a wavelength dither, said polarization mode dispersion compensator having a variable polarization mode dispersion, and an output of said polarization mode dispersion compensator serving as an output of the polarization mode dispersion compensating apparatus;

a polarimeter optically coupled to the output of said polarization mode dispersion compensator and outputting electrical signals representing polarization states of the output of said polarization mode dispersion compensator; and

a controller operatively coupled to said polarimeter and said polarization mode compensator, said controller receiving the electrical signals from said polarimeter, said controller controlling said polarization mode dispersion compensator according to the electrical signal to compensate for the polarization mode dispersion of the input optical signal.

2. The polarization mode dispersion compensating apparatus according to claim 1, further comprising a signal source for generating the input optical signal with the wavelength dither, wherein the input optical signal is transmitted across optical fiber and/or components that cause the input signal to have the polarization mode dispersion.

3. The polarization mode dispersion compensating apparatus according to claim 1, said polarimeter including:

a first polarizer optically coupled to said polarization mode dispersion compensator, said first polarizer plane polarizing the optical signal output from said polarization mode dispersion compensator at first polarization angle;

a second polarizer optically coupled to said polarization mode dispersion compensator, said second polarizer plane polarizing the optical signal output from said polarization mode dispersion compensator at a second angle different than the first angle;

a third polarizer optically coupled to said polarization mode dispersion compensator, said third polarizer circularly

polarizing the optical signal output from said polarization mode dispersion compensator;

a first photodetector optically coupled to said first polarizer and outputting a first detection signal;

a second photodetector optically coupled to said second polarizer and outputting a second detection signal; and

a third photodetector optically coupled to said third polarizer and outputting a third detection signal.

4. The polarization mode dispersion compensating apparatus according to claim 1, said controller controlling said polarization mode dispersion compensator so as to minimize a sum of the squares of the first, second and third detection signals to compensate for the polarization mode dispersion of the input optical signal.

5. The polarization mode dispersion compensating apparatus according to claim 1, said polarization mode dispersion compensator including:

a polarization controller optically coupled to the input port and receiving the input optical signal;

a first birefringent component optically coupled to said polarization controller;

a variable retarder optically coupled to said first birefringent component; and

a second birefringent component optically coupled to said variable retarder, said controller being operatively coupled to said polarimeter, said variable retarder and said polarization controller, and said controller controlling said variable retarder and said polarization controller according to the electrical signal to compensate for the polarization mode dispersion of the input signal.

6. The polarization mode dispersion compensating apparatus according to claim 5, said polarimeter including:

a first polarizer optically coupled to said second birefringent component, said first polarizer plane polarizing an optical signal output from said second birefringent component at an angle parallel to an optic axis;

a second polarizer optically coupled to said second birefringent component, said second polarizer plane polarizing

the optical signal output from said second birefringent component at an angle not parallel to the optic axis;

a third polarizer optically coupled to said second birefringent component, said third polarizer plane circularly polarizing the optical signal output from said second birefringent component;

a first photodetector optically coupled to said first polarizer and outputting a first detection signal;

a second photodetector optically coupled to said second polarizer and outputting a second detection signal; and

a third photodetector optically coupled to said third polarizer and outputting a third detection signal.

7. The polarization mode dispersion compensating apparatus according to claim 6, said controller controlling said polarization mode dispersion compensator so as to minimize a sum of the squares of the first, second and third detection signals to compensate for the polarization mode dispersion of the input optical signal.

8. The polarization mode dispersion compensating apparatus according to claim 5, wherein said polarization controller and said retarder are integrated electrooptic waveguide devices or liquid crystal components.

9. The polarization mode dispersion compensating apparatus according to claim 4, said controller utilizing an adaptive learning algorithm to further minimize the sum of the squares of the first, second and third detection signals and further compensate for the polarization mode dispersion of the input optical signal.

10. A wavelength division multiplexed optical communication system, comprising:

a plurality of optical transmitters, each emitting a corresponding one of a plurality of optical signals, each of the plurality of optical signals being at a respective one of a plurality of wavelengths and having a respective wavelength dither;

an optical combiner having a plurality of inputs, each of the plurality of inputs being coupled to a respective one of

said plurality of optical transmitters, and an output supplying the plurality of optical signals to a first end portion of an optical communication path;

an optical demultiplexer having an input configured to be coupled to a second end portion of the optical communication path, and a plurality of outputs, each of the plurality of outputs of said optical demultiplexer supplying a respective one of the plurality of optical signals;

a plurality of polarization mode dispersion compensating apparatuses according to claim **1**, each of the apparatuses being coupled to a respective one of the plurality of outputs of said optical demultiplexer;

a plurality of optical receivers, each of the receivers being coupled to a respective one of the plurality of outputs of said polarization mode compensating apparatuses.

**11**. The wavelength division multiplexed optical communication system according to claim **10**, further comprising:

a plurality of optical amplification devices arranged in series along the optical communication path.

12. A method of compensating an input optical signal having polarization mode dispersion, comprising:

dithering a wavelength of the input optical signal so as to vary around a center wavelength;

compensating the polarization mode dispersion of the input optical signal with a variable polarization mode dispersion compensator, wherein an optical signal output of a polarization mode dispersion compensator serves as an output of a polarization mode dispersion compensating apparatus;

polarizing the optical signal output from the variable polarization mode dispersion compensator to generate polarized component optical signals;

detecting polarized component optical signals to generate detection signals; and

controlling said compensating step according to the detection signals.

13. The method of compensating an optical signal having polarization mode dispersion according to claim 12, wherein:

said polarizing step includes subjecting the optical signal output from the variable polarization mode dispersion

compensator to plane polarization at a first polarization angle, plane polarization at a second angle different that the first angle, and circular polarization; and

said detecting step includes detecting the three polarized optical signals to output a first, second and third detection signals.

**14.** The method of compensating an optical signal having polarization mode dispersion according to claim **13**, wherein said controlling step includes controlling said compensating step according to the first, second, and third detection signals.

**15.** The method of compensating an optical signal having polarization mode dispersion according to claim **14**, wherein said controlling step includes minimizing a sum of the squares of the first, second, and third detection signals.

**16.** The method of compensating an optical signal having polarization mode dispersion according to claim **15**, wherein said controlling step includes adaptively learning to minimize the

sum of the squares of the first, second, and third detection signals.

17. The method of compensating an optical signal having polarization mode dispersion according to claim **12**,

wherein said compensating step includes:

changing principal polarization states of the optical signal;

inputting the optical signal from said controlling step to a first polarization mode compensating element;

retarding a phase angle of principal polarization states of the optical signal output from the first polarization mode compensating element; and

inputting the optical signal from said retarding step to a second polarization mode compensating element;

wherein said polarizing step includes subjecting the optical signal output from the variable polarization mode dispersion compensator to plane polarization at a first polarization angle, plane polarization at a second angle different that the first angle, and circular polarization;

wherein said detecting step includes detecting the three polarized optical signals to output a first, second and third detection signal; and

wherein said controlling step includes controlling said changing step and said retarding step according to the first, second, and third detection signals.

**18.** The method of compensating an optical signal having polarization mode dispersion according to claim **17**, wherein said controlling step includes minimizing a sum of the squares the first, second, and third detection signals.

**19.** A polarization mode dispersion compensating system, comprising:

a polarization mode dispersion compensator optically coupled to an input port and receiving an input optical signal having polarization mode dispersion, said polarization mode dispersion compensator having a variable polarization mode dispersion, and an output of said polarization mode dispersion compensator serving as an output of the polarization mode dispersion compensating system;

a Q detector operatively coupled to the output of said polarization mode dispersion compensator, said Q detector outputting an electrical signal representing an edge sharpness of the optical signal output from said polarization mode dispersion compensator; and

a controller operatively coupled to said Q detector and to said polarization mode dispersion compensator, said controller receiving the electrical signal from said Q detector;

said controller controlling said polarization mode dispersion compensator to minimize the Q represented by the electrical signal to compensate for the polarization mode dispersion of the input signal.

**20.** The polarization mode dispersion compensating system according to claim **19**,

wherein said polarization mode compensator includes:

a polarization controller optically coupled to the input port and receiving the input optical signal having the polarization mode dispersion;

a first birefringent component optically coupled to said polarization controller;

a variable retarder optically coupled to said first birefringent component; and

a second birefringent component optically coupled to said variable retarder;

wherein said controller is operatively coupled to said Q detector, said variable retarder and said polarization controller, said controller receiving the electrical signal from said Q detector; and

wherein said controller controls said variable retarder and said polarization controller to minimize the Q represented by the electrical signal to compensate for the polarization mode dispersion of the input signal.

**21.** The polarization mode dispersion compensating apparatus according to claim **1**, wherein said polarimeter detects said polarization states of the output of said polarization mode dispersion compensator in at least three degrees of freedom.

**22.** The wavelength division multiplexed optical communication according to claim **10**, wherein at least one polarization mode dispersion apparatus includes a polarimeter

configured to detect polarization states of an output of a corresponding polarization mode dispersion compensator in at least three degrees of freedom.

**23.** The method of compensating an optical signal having polarization mode dispersion according to claim **12**, wherein said polarizing step includes generating the polarized component optical signals in at least three degrees of freedom.